DOCUMENT RESUME

ED 441 796 SP 039 254

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TITLE Teachers Training Teachers: Four Perspectives on an Innovative Mentoring Program for Intern Science Teachers.

SPONS AGENCY Arthur Vining Davis Foundations, Miami, FL.

PUB DATE 2000-04-00

NOTE 28p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 24-28, 2000). Also supported by the Stuart Foundation.

PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.

DESCRIPTORS *Beginning Teacher Induction; Beginning Teachers; *College School Cooperation; Graduate Study; Higher Education; *Mentors; Partnerships in Education; Program Development; Program Evaluation; *Science Teachers; Secondary Education; Teacher Collaboration; *Teacher Interns; *Teacher Role; Urban Schools

IDENTIFIERS San Francisco Unified School District CA; University of California Berkeley

ABSTRACT

The Graduate School of Education (GSE) at the University of California at Berkeley (UCB), the San Francisco Unified School District (SFUSD), and the Lawrence Berkeley National Laboratory (LBNL) have collaborated to pilot an on-site training and mentoring program for intern science teachers. Exit interviews suggest that its innovative mentoring structure and other elements could improve the quality of science teaching and the quantity of prepared teachers in urban schools. This paper presents an overview of the "Scientist to Teacher" program development, including the rationale for partnerships to support teacher internship training and a description of the program's design principles and implementation. The paper reports on the intern teacher's role in the program and one first-year teacher's experiences. It also reports on the master practitioner's role in the program and one master teacher's experiences working in the program's design year and participating in a summer internship at LBNL. Finally, the paper highlights the roles and responsibilities of the lead teacher in the program. (Contains 10 references.) (Author/SM)

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ED 441 796

TEACHERS TRAINING TEACHERS:

FOUR PERSPECTIVES ON AN INNOVATIVE MENTORING PROGRAM FOR INTERN SCIENCE TEACHERS

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TEACHERS TRAINING TEACHERS: FOUR PERSPECTIVES ON AN INNOVATIVE MENTORING PROGRAM FOR INTERN SCIENCE TEACHERS

Abstract

The Graduate School of Education (GSE) at the University of California at Berkeley (UCB), the San Francisco Unified School District (SFUSD) and the Lawrence Berkeley National Laboratory (LBNL), have collaborated to pilot an on-site training and mentoring program for intern science teachers. Exit interviews suggest that its innovative mentoring structure and other elements could improve the quality of science teaching and the quantity of prepared teachers in urban schools. In this paper we overview our *Scientist to Teacher* program[1] development including the rationale for partnerships to support teacher internship training and a description of the program's design principles and implementation. We report on the intern teacher's role in the program and one first-year teacher's experiences. We also report on the master practitioner's role in the program and one master teacher's experiences working in the program's design year and participating in a summer internship at LBNL. Finally, we highlight the roles and responsibilities of the lead teacher in the program.

Program Development

There are not enough suitably trained science teachers able and willing to sustain their careers in urban high schools (California Commission on Teacher Credentialing, 1998; National Center for Educational Statistics [NCES], 1999). Like nearly every challenge beleaguering our educational systems, a multiplicity of factors undermines simple, straightforward solutions to preparing and retaining more good teachers. Systemic and comprehensive approaches—thinking outside the box—are essential. And instead of offering solutions, some teacher-training institutions of higher education appear to duck the problem by treating their credentialing programs as "cash cows which are conducted on a shoestring and used to fund programs in other fields" (National Center for Research on Teacher Learning, 1995). Critics argue that schools of education should be more

[1] Principal Investigator, Eugene Garcia, Dean of the Graduate School of Education, University of California, Berkeley

"intellectually solid" and more connected to elementary and secondary schools Holmes Group, 1986). We have created and piloted an innovative model to attract talented scientists and content experts into the teaching profession through a collaborative partnership of the San Francisco Unified School District, the University of California at Berkeley Graduate School of Education and the Lawrence Berkeley National Laboratory.

The aim of our pilot program, named *Scientist to Teacher*, was to develop a vehicle to train teachers concurrently with their first year of teaching, similar to medicine, without sacrificing the quality of program necessary for preparation to teach in today's schools. Teacher education is seldom based on collective mentoring and reflective inquiry during the crucial first year of teaching but rather stems from university based pre-service preparation and a student teaching experience which is far from reality. Our model matches master teachers with science-trained interns in their first year of teaching and provides them teacher-training modules created by university faculty and presented on-site in the teacher's own classrooms. In this module structure for preparing teacher education interns, new teachers have the opportunity to immediately apply theory to practice rather than learning information that seems to have little value outside the reality of a classroom. A key element in the program is the granting of released time to intern and master teachers alike for curriculum preparation, discussion, workshops, and teacher-training. The program also promotes teacher/scientist partnerships that provide training in research processes and advanced laboratory techniques, as well as, friendships and teaching resources.

The role of mentoring in learning to teach. The model we developed is based on research showing the efficacy of mentoring relationships in the development of

new teachers and in professional growth for experienced teachers (Bartunek, 1990). Current research suggests that mentoring is most successful when it includes the following elements: providing release time for mentors to meet with trainees; a grounding in theory, meeting with other mentors; introductory training for the mentors; and an awareness of what the teacher trainees are learning. Mentoring can be equally beneficial for mentor teachers and those who are mentored; however, a mentoring relationship does not automatically improve a teacher's classroom performance. Often a mentoring program finds itself separated organizationally from the teacher training program, making it difficult for mentors to relate their practical assistance directly to the pedagogical theory an intern is learning (Feiman-Nemser, Parker, & Zeichner, 1992). An analysis of intern mentoring by the National Center for Research on Teacher Learning concludes that mentors need time to mentor and opportunities to learn to mentor (NCRTL, 1995). Some mentoring programs support only a few meetings between the mentor and mentee each year. Research findings from the NCES report on teacher preparedness indicate that teachers who participated in a mentoring or collaborating activity *at least once a week* felt better prepared to implement state or district curriculum and performance standards and to deal with diversity in the classroom (NCES, 1999).

Often teachers are isolated in their classrooms and provided little assistance with their duties. Cross-cultural research shows that teacher attrition is decreased when interaction with other teachers is maximized, when dedicated time is provided for planning and collaboration, and when new teachers are provided with guidance and resources for managing classroom duties (Asian-Pacific Economic Cooperation, 1997; Moskowitz & Stephens, 1997). The pairing of an experienced teacher with a new teacher can be an important mechanism for productive exchange of ideas and reflection about practice and can be particularly useful to new teachers

as they seek to develop effective teaching practices. The mentoring relationship provides support for two principles of excellent teaching proposed by the National Board for Professional Teaching Standards--teachers should think systematically about their practice and learn from experience and teachers should be members of learning communities (NBPTS, 1991).

Program Design Principles

Teachers training teachers. The scarcest commodity for teachers, new and veteran alike, is time. *Scientist to Teacher,* as a model for teacher preparation, includes daily release time for interns to train and release time for teacher coaches to work with intern teachers. The model is a collaborative professional partnership between higher and K-12 education. The majority of the education and induction of intern teachers occurs on-site, with a professional development team of educators. The team's primary task is to prepare the intern educators to fully assimilate and apply the new skills and pedagogy necessary to teach the students in their classes.

Learning in context. Intern teachers who learn in context gain more understanding of educational theory and its application in the classroom. In our program, teachers actively participate in their own learning, and then apply what they have learned directly in their own classrooms with the coaching and mentoring of master practitioners who work directly with higher educators. Assignments emphasize applying research and theory in the teachers' classrooms. Master teachers observe interns in their classrooms to discuss specific topics from courses, and intern teachers observe master teachers modeling good practice.

Theoretical grounding. The faculty of the Graduate School of Education partners with faculty from K-12 to build frameworks and theories as well as the

scientific knowledge base for the developing teacher. In our program, students engage in professional research and work with faculty in research partnerships. An emphasis on formative student assessment and personal evaluation encourages teachers to view their classrooms as experimental settings where they can make sense of emerging ideas in educational research. The school becomes a laboratory where theory can be applied with the coaching and mentoring of veteran teachers.

Reflection. The new teacher should be a reflective, knowledgeable, and engaged learner and teacher. Teachers must understand both how to teach and why they are teaching and learning as evaluated in their reflections. In our program, specified weekly release time is designated to reflective research reading for master and intern teachers, journal writing, observation of lessons, videotaping/analyzing lessons, and building career portfolios. This embedded reflection promotes the linking of theory and practice in ways that bear the immediate imprint of the teachers and students involved and lead to a model that more effectively meets the needs of rapidly evolving classrooms and students.

Real-world skills in teaching and learning. Teaching should incorporate real world skills such as laboratory research and the ability to connect concepts in the classroom to applications outside the classroom that are meaningful to students. In our program, teachers experience work in real world situations such as training as partners with laboratory scientists at Lawrence Berkeley National Laboratory. Their teaching incorporates their experience into curriculum planning. Our beginning teachers are engaged in preparing students who are prepared to engage in authentic and significant work in the society outside of school.

Program Description

We recruited twelve teachers for the development year (1998-99) of our new internship program. Four master teachers and eight interns, who were teaching on emergency permits, spent one school period each day (one hour) to both train and work with project members to develop the site-based teacher education program. School-based cohort groups were composed of two interns and one master practitioner in each site-based school cohort. There were three cohorts at the high-school level (one math-oriented and two science-oriented) and one cohort at the middle school level (science-oriented). The site-based cohorts joined counterparts from other schools in the San Francisco Unified School District to form the larger university intern program cohort that met weekly after school for several hours. Master practitioners engaged in training with UCB faculty before they began their work with their intern teachers. Several full-day design meetings were scheduled to bring the entire cohort of teachers together with more faculty from UC Berkeley and researchers from LBNL. These design meetings provided the opportunity for on-going changes in the program based upon feedback from all participants. At the conclusion of the development year, the intern and master teachers were interviewed to gain more feedback for future development.

Curriculum modules were delivered at on-site, full-cohort meetings by UC Berkeley faculty. Assignments and activities to satisfy credential requirements were presented and discussed at full cohort meetings. Cohort homework and module assignments were refined and shaped to meet the needs of individual interns and their classes in the school site cohort meetings during the daily release time period. The site-based mentor provided guidance and expertise to help the intern apply theory to the actual practice of the classroom. Mutual observation and peer coaching occurred on site, including, debriefing and redesign of intern lessons.

Framework for linking theory and research to practice. Each curriculum module (approximately four weeks in length) begins with a review of current research, highlighting faculty who specialize in the research. Best practice is similarly reviewed, and a researcher/practitioner team begin the module with presentations and discussions with the full cohort. With the guidance of program instructors and faculty, the school team designs pedagogy that is shaped and infused with both research and best practice. Units or lessons are developed that incorporate the learning goals and objectives of the credential requirements as tailored to each individual teacher's student needs. Theory is applied through the practice of the intern teacher, directly in the teacher's classroom. The master practitioner acts as peer coach and mentor, providing the intern with the opportunity to observe a variety of teaching styles and applications based on the experienced teachers' familiarity with, and access to the school faculty. Debriefing, and redesign of observed lessons in small group cohort work adds the factor of instant feed back to the developing intern teacher. The structure of the overall framework for linking theory and research to practice is represented in Table 1. Table 2 provides a summary of a typical week's lesson plan.

Table 1. Framework for linking theory and research to practice.

Program Goal	Research -->	Pedagogy -->	Practice -->	Reflection -->
Activity	research articles classroom-based research projects	speakers and activities	homework (e.g., design lesson) lesson observation	review homework review module activities lesson videotaping and analysis
Time	readings available before the full cohort meeting on the topic research projects are on-going	full cohort meeting cohort group meetings	intern with master practitioner	cohort group meetings journal writing

Table 2. Summary of a lesson plan for the first week of a four week School-to-Career curriculum module.

	Full Cohort Meeting	Cohort	Intern
Readings	Reading JigSaw Guilano, F.J., *Practical Professional Portfolios*		What is School-to Career? Examples of School-to-Career.
Activities	Overview of Topic SCANS resume revision Review professional portfolios	Mentors share STC ideas Investigate student resumes and portfolios Observe MP lesson for SCANS skills	
Assignments		Plan lesson with SCANS	Adapt MP skill for lesson
Reflection/ Extension	Attention to teacher resume and portfolio	Adapt assignment to meet individual teacher situation Incorporate MP suggestions	Journal writing Student assignment on resume

Program Evaluation: Exit Interview Responses

Interns viewed the mentor relationship as one of the central strengths of this teacher-training approach. Interns commented that "having a mentor on site was key to responding to problems *du jour*" and that "interaction with my mentor made the topics we covered applicable specifically to my classroom and experiences." For new teachers, the benefits of the mentor relationship were strongly linked to the release time they were granted to make the most use of this interaction. Interns reported that they likely would not have sought out help from the master practitioners if the mentors had not also been paid for their release time. Having a mentor accessible on-site provided immediate response to problems as they arose. A benefit of meeting with both new and master teachers was that interns could see the different stages that teachers were at and reflect on the continuum of teaching skills. Interns commented that the emphasis on reflecting on their teaching, assessing their current skill level, and reaching for higher goals was a strength of the program.

The master practitioner teachers, through their role as teacher educators, found that the project provided them with incentives to stay in the classroom and utilize their expertise to the fullest, rather than leave the profession in order to advance in their career. They agreed that the highlight of their participation in *Scientist to Teacher* was the sense of community that resulted from working closely with other mentors and interns. Master practitioners described the teaching profession as isolating and commented that regular cohort group meetings during a release-time period "relieved the sense of working in a vacuum," helped them "learn a lot about [their] teaching style and methods and about others," and "provided a form of accountability for [their] own teaching." Overall, they became more aware of their own teaching as they became aware of the struggles of the new teachers.

Although the 1998-99 development year was incomplete in many respects, the interns as a whole felt that their participation in this model program was a far better experience than their participation in other credential programs, which were perceived as being too fragmented and unrelated to their actual classroom experiences. The advantage of this program in one intern's words is "experience in the classroom at the same time as theoretical learning...The theory presented in traditional credential classes is not as useful because it doesn't have an immediate application." As a group, the intern and master teachers reported that they would gladly participate in a credential program following this new model because it created a "sense of community in an often isolating career," provided time and opportunity for reflection on their teaching, and integrated theory with classroom practice. In one intern's words, "The program made me want to stay in teaching and try to improve myself."

Next Steps: REPLICATE

The UCB Graduate School of Education is continuing in its partnership with SFUSD and LBNL to expand the successful *Scientist to Teacher* pilot program into a new teacher credentialing program at the University of California, Berkeley. The new program, called REPLICATE (for Research and Practice Linked in an Internship Credential through Applied Teacher Education)[2], is currently under review for approval by the California Committee on Accreditation. The master teachers who participated in the *Scientist to Teacher* development year continue to work with faculty at UCB in designing a curriculum that links educational theory and scientific practice to classroom practice. The current program design focuses on science instruction; however, future plans include expanding the program to mathematics. The following are elements that we believe are unique to REPLICATE: the partnership between K-12 and higher education in teacher training, the role of experienced teachers as primary partners in developing new teachers, a release time component for teacher training, the learning of theory and the immediate application of the theory, the formation of a career ladder for veteran teachers, and the incorporation of a practical externship at Lawrence Berkeley National Laboratory.

[2] http://www-gse.berkeley.edu/program/replicate/replicate.html

COMMUNITIES OF TEACHERS INTEGRATE THEORY WITH CLASSROOM PRACTICE

David Barrios , Galileo Science Academy

As a *Scientist to Teacher* intern at the Galileo Academy of Science Technology in the 1998 – 1999 school year, my responsibilities were many and varied. The new intern program was markedly different from my colleagues' traditional student teaching program and the support I received from UC Berkeley was invaluable. To assist me in succeeding in the role of a science classroom teacher of tenth grade Integrated Science and Chemistry, I attended daily meetings on site during the extra preparation period I was given for my role in the program. I also attended bi-weekly meetings, kept journals about my progress, studied the implementation of standards, read current scientific and educational journals and articles, observed other teachers and was observed. All these components of the program have helped me to create exciting and relevant curriculum for my students, learn classroom management skills and ease into my role at Galileo.

In a traditional student teaching program, graduate students spend a minimum of one year preparing to teach. The first semester of San Francisco State University's Secondary Education Credential program, for example, requires one full semester of "Observation and Participation" in the schools. Students take coursework at the university in pedagogy and educational theory concurrent to observation in the schools. This aspect of the program introduces prospective teachers to the realities of teaching slowly; it is not until the end of the semester that students select their student teaching sites and master teachers for the following semester. In the second semester of this program, student teachers take over two classes with two different teachers in their credential areas and are also responsible for a "third hour," in which they assist a different teacher with a different class. Meanwhile they attend more pedagogy and theory classes at the university.

Obviously, this traditional program is unattractive to many prospective teachers: it is expensive because it requires graduate level tuition for at least one year (this tuition does not include the cost of the four additional "clear credential" courses); full time work while attending this time consuming program is difficult to arrange; the cost is prohibitive from professionals entering teachers from higher-paying fields; and, it is time consuming. Consequently, I was thrilled to join the *Scientist to Teacher* program when my department head offered me the opportunity.

Not only did *Scientist to Teacher* get me into the classroom right away, it helped me become a confident teacher because of the myriad avenues of support it provided. One of the obligations of the program was attending bi-weekly meetings hosted by different schools participating in the program. These meetings offered a chance for mentors from the program and its interns to have both supportive and collegial discussions, share successes and failures and gain insight into the field. The teacher demonstrations were helpful because they gave us curriculum ideas. The guest speakers helped us to learn about current scientific research in the field, successful classroom management techniques including the issue of homework assignment, and good teaching ideas. During one of these bi-weekly meetings we were given a presentation on how to prepare for observations of our mentors and our peers so that we would know what to look for when watching another teacher conduct class. Visiting other teachers' classrooms was also helpful to me because I was able to view different ways to set up my own classroom.

The *Scientist to Teacher* program emphasized aligning our curriculum with the San Francisco Unified School District Science and California State Standards. I found this practice helpful to my career because not only did it increase my knowledge of how to give the students the most effective curriculum possible, but it also helped me learn how to align my own assignments with curriculum. In

addition to the standards we utilized the "Effective Teaching Rubric" to help us assess ourselves as teachers and to help us to create realistic goals for our students and ourselves. While completing the homework for the program, which included writing journals, reflecting on our teaching and students, reading journals and articles from the field and creating lesson plans for our classes, we were able to integrate these standards. Consequently, we have become thorough and effective teachers quickly.

The homework obligations for the program were as follows: biweekly guided journals; lesson plans focused on a specific aspect of teaching, including effective time management or career oriented lesson plans; readings of journals and articles by seasoned educators and experts in the fields of curriculum writing and English Language Development students; observations of both our mentor teachers and our fellow interns. In addition, our mentors observed us monthly to give us feedback, suggestions and guidance.

The *Scientist to Teacher* program provided opportunities for field trips, both through the larger group and through our smaller site team. With the latter, we visited teacher resources in the Bay Area such as the UCSF teacher resource library. In all, the field trips helped us to learn about student science resources in the general bay area, including the Exploratorium and the Lawrence Hall of Science. More importantly, the program helped facilitate partnerships with these community organizations.

The most valuable aspect of the program was the extra preparatory period that all of the interns and the mentors shared. We used this time to share curriculum ideas, do our program homework, prepare for labs, collect materials, observe other teachers and bounce ideas off each other. Not only was the extra time useful for completing assignments and preparing student assignments, but it also helped us to

create a sense of camaraderie. The interns at Galileo became both a network and a support for me. This time helped to alleviate the myriad pressures on a first-year teacher. With this time together, we were able to share many resources and ideas, which cut down on planning time considerably.

Being a pilot program, there were definitely many faults. One of the obvious ones was the lack buy-in with the homework. At the time I was concurrently finishing my credentialing program at San Francisco State University. Unfortunately this put the homework for the *Scientist to Teacher* program after my class preparatory work and credentialing homework. During many meetings I felt that they would have been much more fruitful if I had spent more energy on the homework. This accountability issue would be remedied when the *Scientist to Teacher* program is the intern's actual credentialing program. My other main observation of the program was the relevancy of the speakers. The diversity of the group and depth of the subject matter made the fluidity of the program difficult. To cover the material in these meetings and still provide the interns with useful information is a definite challenge for a program such as this.

I have found that by sharing my successes and failures with my peers at Galileo, rather than with the student teachers from other schools I would have interacted with in a traditional teaching credential program, my transition to my second year of teaching was made very smooth. The camaraderie created by the program was priceless. With the loss of this meeting time with my peers, I have already felt the growth of isolationism as we once again drift away to our rooms, lacking the time to interact. If given an option, I would have chosen a well planned *Scientist to Teacher*-type program over the traditional credentialing program. It is more appealing in today's economy and provides much more support to a new teacher during a critical time period where that little extra bit means so much.

EVERYONE BENEFITS: INTERN MENTORING IMPROVES PRACTICE FOR MASTER TEACHERS

Heather O'Connor, Galileo Science Academy

Overall structure. At Galileo Academy, *Scientist to Teacher* was structured as follows: 2 "Master Practitioners", both teachers with 4 years teaching experience, and 4 "Intern Teachers". The four intern teachers were all teaching for their first year. Two of the teachers were taking credential courses at San Francisco State University. Our cohort meeting time was during the last period of the day. We either spent this time a) discussing "crisis" issues which may have come up during the day, or b) planning/adapting lessons assigned for "homework", or c) debriefing after an observation (usually a master practitioner debriefing the interns regarding an observation of the intern teacher), or d) reading for the whole group meetings or e) writing journals. We met with teachers from other schools every other Tuesday for several hours after school.

Strengths of the program. *Scientist to Teacher* decreased the sense of isolation that I was feeling, a feeling that many of us feel as teachers. It was wonderful to have time at the end of the day devoted to communicating with each other and trying to solve our common problems in creative ways. It is very easy to go through the whole day in your own classroom interacting with only teenagers. Before *Scientist to Teacher*, the extent of my interaction with other adults was often a hello in the bathroom, passing by each other in the halls, or waiting in line in the copy room. Sometimes our cohort group meeting would be spent trying to figure out how to deal with one problem student in particular, and such conversations would trigger me to apply these creative ideas to my own students with behavior issues. Of course, we often spent 10 minutes or so just "catching up", asking about each others' day, asking about life outside of school. Many of us decided to go into teaching out

of a spirit of service, but it's easy to forget that we all have lives outside the classroom. The informal dialog that peppered our meetings helped to maintain a balance between work and home, a balance that I feel is necessary if we are to be fully present for our students.

Scientist to Teacher fostered a sense of professionalism. I appreciated our meetings with other educators and professors from U.C. School of Education. I especially benefited, for example, from our meeting with a researcher and an expert teacher who presented together on the benefits and pitfalls of Academies within schools, since my particular high school is undergoing a transformation into several academies. It is easy to forget that there are people that are making an effort to determine the most effective ways for students to learn and for teachers to teach. So often teachers are given so little support; we are expected to automatically know how to teach each concept and each lesson. In many ways, we are left to fend for ourselves. I always came away from each meeting with researchers and other teachers with a sense of hope, and I left the meetings with at least one new nugget, one new strategy I could try, or one new reason to stay my same course (like advocating gradual change into academies for our school).

This same sense of professionalism was fostered by our readings as well. It was wonderful to actually have time set aside to do these readings, such as articles from "The Science Teacher" and excerpts from books like "Teaching to Change the World". At Galileo, we devoted our Thursday block seventh period (2 hours) to reading these articles either at school or off site. For example, one article prompted me to try different seating arrangements in my classroom, like a circular pattern and a dice pattern. The data in the article seemed so compelling; student performance and participation was increased by this seemingly small and simple change.

With every passing year, I have become more and more complacent about "growing" as a teacher. Last year during *Scientist to Teacher* I was finally teaching courses that I had taught the previous year. Most days I simply pulled from my file cabinet or computer the lesson plans and hand-outs from the previous year. Since the first year of teaching a course is largely a survival year, some of these lesson plans were lacking cooperative learning strategies, clear objectives, etc. Almost every two weeks of *Scientist to Teacher*, our assignments consisted of adapting existing lesson plans to include whatever focus we were learning at the time, such as cooperative learning strategies or using inquiry-based activities. This enabled me to adapt and improve upon my existing files of lessons. The best part, though, is that I was given time during the school day to do this (during our common seventh period). It's so difficult sometimes to go home and make these adaptations in addition to parent phone calls, planning field trips, grading, etc. Another huge benefit was the opportunity to bounce ideas off of the other interns and master practitioners. Sometimes the interns would come up with a great lesson that I could also use in my classes, and often I would adapt a lesson which they could use as well. This sense of collaboration is what teaching needs more of; it's empowering to know that creative lessons that we have devised are being used in classrooms other than ours.

I learned just as much, if not more, from the intern teachers as they learned from me. Sometimes they would ask questions about topics that I thought I knew the answer to, but as we sorted out the answers together, I would realize I didn't. Some examples include the proper sequence in planning a field trip (I had been doing this "improperly" - shock! horror!) and how to use the PA system. In addition to learning (or reinforcing) some of these "nuts and bolts" issues, in the process of brainstorming together on topics like what labs are appropriate for their

classes, or what discipline techniques are effective, they came up with ideas that I would not have come up with on my own. For example, I have trouble coming up with simple ways of organizing materials for a lab so that the materials are both accessible for students and not an overwhelming task for me. When I would observe an intern teaching such labs, I would come away with new ideas on organization of materials, clean up incentives, and new questions to ask of students throughout the lab.

The *Scientist to Teacher* program provided a combination of theory and practice, but with a welcome emphasis on practice. Most traditional teacher training programs include a semester of Observing and some course work, which is then followed by a semester of Student Teaching and limited course work. One would think that teaching 2 classes per day during student teaching would prepare you for your first job where you are likely teaching 5 classes. I did not feel adequately prepared. All that theory (and it wasn't all that much) that I had the first semester of the program seemed like a distant memory. As teachers we have learned that students learn better when it is relevant to them, when we give them real world examples. Why shouldn't a teacher training program be structured with this philosophy in mind? When I was assigned readings on teaching reading or behavior issues, I could not retain the messages because I had not taught in a classroom yet, so I had no schema to which I could apply them. In the *Scientist to Teacher* program, interns and "veterans" alike, we planned lessons that we would really teach, as opposed to the lessons I wrote during my Science Curriculum and Instruction class, only one of which I actually used the following year.

We were able to draw upon the diverse backgrounds of everyone in the group. One teacher had a master's degree in chemistry. He was helpful in filling in those "blanks" that are not thoroughly covered in teacher's editions of laboratory

manuals and the like. Often the publishers assume that we know, or that we actually remember from our Organic Chemistry classes, the reasons for the different disposal methods for different chemicals or real world applications of chemistry. As we all know, as science teachers we need to be somewhat versed in all of the basic sciences (chemistry, physics, and biology), so it was great to tap into this particular teacher's wealth of knowledge about how different elements and compounds are made or used in industry. Another teacher had worked at a nearby GGNRA (Golden Gate National Recreation Area) park, so he had contacts there and ideas on which sections of the park contained interesting flora and fauna. These areas of expertise were infused into the intern teachers School-to-Career units. These units were amazing; in some cases the teachers ensured there was a school-to-career connection made every day. For example, in the chemistry teacher's unit on the periodic table, he included a real world example of how the elements were used in the world. On the other hand, one teacher who was a musician included illustrations of how music and musical instruments can help us understand the properties of sound waves, like amplitude, frequency, pitch, and beats. Another teacher had a background in both pharmaceutical research and business, so she had students track the stock of pharmaceutical companies as well as investigating new products "in the pipeline" of these companies.

We were able to meet teachers with other schools! It was broadening to see how the teachers, departments, and student population differed from school to school. It was especially interesting to interact with middle school science teachers and find out the topics that they covered with their students.

Scientist to Teacher was a lot of fun! It was enjoyable to work with a group of people from diverse backgrounds science, to brainstorm ideas together, and I remember a lot of laughter during that seventh period over the course of the year.

Areas to improve. Due to a scheduling problem, a UCB faculty member could not do the peer coaching training to the extent he wished. I think this part of the program is extremely key to its success. There will always be an erroneous perception on every one's part that somehow the "veteran" teachers (this seems a misnomer; my co-master practitioner and I had only 8 years teaching experience combined) are the experts and the interns are to be "taught" by the "veterans" how to be good teachers. Sufficient training in peer coaching is necessary if the program is to be successful. It was difficult to convey in post-observation sessions that points discussed are intended to help the interns improve in areas on which they chose to focus. Perhaps an equal number of assigned observations of master teachers would help all teachers to feel comfortable and open to constructive criticism. The interns did observe the master practitioners on occasion, but not as often as we observed them. Also, in choosing master practitioners, perhaps those who are in an obvious position to potentially hire the teacher interns should not be a part of the program. To some degree, a sense of hierarchy in the *Scientist to Teacher* program is unavoidable, but I think that spending more time on peer coaching training would help to foster a freer exchange of ideas.

It decreased my sense of isolation. Hey, wait a minute, I thought that was one of the strengths of the program. The way most the school day at most high schools are structured, i.e. with little or no common planning/meeting time, teachers are isolated from each other. Of course, in the end, this is not a good thing. However, it is also easy to avoid difficult conflicts with other adults. Some would argue that dealing with a conflict with a student is relatively easy compared with those between peers, people we perceive as our equals. There were some difficult decisions which had to be made over the course of *Scientist to Teacher*. Certainly these conflicts only helped us to grow as professionals as we strove to deal with

them in the fairest, most reasonable manner. We have a better sense now about what to look for in a potential intern, for example.

In this pilot year of *Scientist to Teacher*, sometimes our seventh period meetings seemed "unstructured." Although we usually had to write lesson plans with specific foci (discipline, clear objectives etc.), often we found ourselves discussing how to plan a field trip, or choosing what laboratory exercise to illustrate a particular science concept, or something else "off topic." In many respects, this was wonderful, and when I was student teaching I would have appreciated this time devoted to such topics. I wonder, though, if more frequent large group meetings with the "threat" of a grade would have compelled us to spend more time on the assignments. I suppose when you have to write a good lesson plan every week, you do build up an arsenal of lessons for the next year. This is a benefit of the more traditional program. I appreciated the flexible, social time we had during our seventh period meetings, but I think we needed the incentive of grades and/or the expectation that you share your progress with the other *Scientist to Teacher* participants every week.

ROLES AND RESPONSIBILITIES OF THE LEAD TEACHER

Jennifer Fong , Mission High School

The Lead Teacher in a school district plays a critical role in the smooth and effective operation of an alternative teacher credentialing program, like *Scientist to Teacher*, which relies heavily on mentoring from experienced teachers. The Lead Teacher's expertise is most helpful in recruiting mentor teachers, navigating district bureaucracies, acting as a liaison between teachers and the University and consulting on program design to meet the particular needs of the district and to provide the voice of a currently practicing teacher.

In particular, the Lead Teacher in the San Francisco Unified School District is especially important due to the large district size and the number of existing programs. As the contact person for the master teachers and interns, the Lead Teacher utilizes his/her experience and familiarity with district policies and key personnel, including science department heads, school administrators and district administrators, to negotiate particular issues, such as teacher selection and release time. Since the SFUSD is involved in a variety of professional development programs both in the sciences and for new teachers, the Lead Teacher coordinates services between *Scientist to Teacher* and existing programs.

The *Scientist to Teacher* model not only recruits and trains teachers to fill a constant shortage area, but also works to retain quality science teachers by promoting leadership within schools and the district. *Scientist to Teacher* provides an unparalleled experience which might keep teachers in a district which consistently underpays and mistreats its employees compared to surrounding districts.

Recruitment of mentor teachers. As a colleague, the Lead Teacher is part of the science teacher community and is able to identify and recruit good mentor

teachers. The Lead Teacher is able to use his/her connections with district curriculum specialists in science and science department throughout the district to determine which schools best match *Scientist to Teacher* criteria.

The Lead Teacher follows-up on references and recommendations submitted by prospective master practitioners. The Lead Teacher also performs formal site visitations and informal discussions with both the prospective MP and his/her colleagues to select a highly qualified and committed corps of veteran teachers. Because the Lead Teacher is "one of their own," he/she may be privy to informal recommendations or criticisms, which might not be said to an outsider.

The Lead Teacher also provides a measure of accountability to the University and for the relationship between the district and the University. The Lead Teacher is expected to ensure that district partners hold up their end, and to provide feedback to the University about the teachers' needs.

Familiarity with and ability to navigate District workings and mechanisms. From simple items, like securing substitutes for all-day meetings, to more complex issues, such as arranging release time at the end of the day, and hiring a .6 replacement, the Lead Teacher is invaluable. As an experienced teacher in the district, s/he will be familiar with District procedures and be able to cut through the paperwork to make it happen.

Liaison between teachers and the University. The Lead Teacher communicates information between the University and the teachers. Since s/he is both a teacher and a member of the planning committee for *Scientist to Teacher*, the Lead Teacher will consider both points of view in assessments, feedback and evaluations. As a fellow teacher, the Lead Teacher will have a level of credibility

with the interns and master practitioners that is often not present when outsiders (those who are currently non-teaching) lead professional development.

Consultant to program design, especially for tailoring modules to suit particular district needs. On-going development for a program like *Scientist to Teacher* needs someone who is in the trenches so to speak. For example, to know when the marking period ends, so that a discussion of grading and assessment would be appropriate; or to understand what curriculum and standards the district is asking teachers to cover so that the interns' curriculum may be consistent with district requirements. The Lead Teacher will be able to make suggestions about how to make theoretical or bureaucratic necessities into practical applications for the classroom.

In addition, the Lead Teacher provides a mix of theoretical and practical classroom practices. S/he is familiar with the philosophy behind certain required topics (such as mainstreaming) and also understands how to translate the theoretical into practical applications which are realistic and have a high chance of success in the classroom. Many teachers will be more receptive to ideas given by another teacher—someone who has tried these methods and experienced success with actual students.

Building and retaining leadership. Besides the Lead Teacher's role in recruitment, training, support and retention of new science teachers, this position is important in the district to give veteran teachers options for professional growth within the district. The Lead Teacher is likely to be recruited away from the lower paying urban districts or into higher-paying administrative jobs on the school site or in the district. The profession needs quality science teachers. *Scientist to Teacher* proposes a change to the paradigm of promotion within schools. Good teachers can

stay on site to both model and support new teachers, rather than just support as many of the peer assistance programs do. Selection criteria should include the following: demonstrated leadership within the district, teaching excellence, experience with teacher enhancement, commitment to new teachers, familiarity with current research and educational theory, and recommendations from district level, school administration and peers.

Acknowledgments

We would like to thank our funding agencies without whom none of this work would be possible. The *Scientist to Teacher* project was supported in it's development year by an Arthur Vining Davis Foundations Grant. Support for on-going development of the REPLICATE is provided through the Stuart Foundation.

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